25(1) PHASE I BOOK EXPLOITATION SOV/1998

Kidin, Ivan Nikolayevich, Doctor of Technical Sciences, Professor

Tekhnologicheskiye osobennosti termicheskoy obrabotki stali s primeneniyem induktsionnogo nagreva (Technological Features in the Heat Treatment of Steel Using Induction Heating) Moscow, Mashgiz, 1959. 61 p. 4,000 copies printed.

Ed.: M. N. Morozova, Engineer; Tech. Ed.: L. P. Gordeyeva; Managing Ed. for Literature on Metalworking and Machine-tool Construction (Mashgiz): R. D. Beyzel'man, Engineer.

PURPOSE: This book is intended for production engineers.

COVERAGE: The book deals with the special features and advantages of the induction hardening of steel. Specific topics discussed include kinetics of the process, thermal parameters, heating regimes, residual austenite in induction-hardened steel, and tempering of induction-hardened steel. No personalities are mentioned. There are 98 references, 96 of which are Soviet and 2 are English.

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18(2), 18(7)

AUTHOR: Kidin, I. N. SOV/163-59-1-38/50

TITLE: Modifications of the Fine Structure of Nickel Iron During Drawing After High-frequency Hardening (Izmeneniye tonkoy struktury nikelevogo zheleza pri otpuske posle vysokochastotnoy zakalki)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1959, Nr 1, pp 196-202 (USSR)

ABSTRACT: R. M. Paretskaya, Engineer, assisted in the experiments and calculations. This is a presentation of the results of the investigation of fine structure elements and of the strength due to drawing after high-frequency hardening. A nickel-iron alloy was investigated, with a 7.5% nickel constituent. The production of the alloy and the method of interpretation of the X-ray structural photographs of samples after high frequency hardening have been described in the papers cited by references 1 and 2. The samples hardened after each heating, were drawn at 150, 250, 350, 450 and 550° for one hour. In ordinary hardening the grain size reaches a maximum value. It is characterized by the fact that the grain size is maintained during drawing to a comparatively high temperature. A grain

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growth is found to occur only if the drawing is carried out at temperatures exceeding 350°. An acceleration of the heating up to 50 degrees per second guarantees a fine dispersion of the grains. At 250° the grains begin to grow. At a heating rate of 1500 degrees per second even smaller grains are produced. They begin to grow during drawing even at 150°. The strains of second order decrease at much lower temperatures (in comparison to the temperatures at which the grains grow). In ordinary hardening a reduced value of the strains of second order is found at a drawing temperature of 250°. If the heating rate in hardening is 50 degrees per second the temperature at which a reduction of the strains of second order is found is 150°. At a rate of 1500 degrees per second a reduction of the strains in question occurs already at a drawing temperature of 100°. The experiments showed that the consolidation is caused by the grain size and not by the strains of second order. In all cases discussed in this paper a reduction of hardness was found at drawing temperatures equal to those at which the grains grow. The reduction of the strains of second order was found at lower temperatures. In conclusion there is stated that the most

Modifications of the Fine Structure of Nickel Iron During Drawing After High-frequency Hardening SOV/163-59-1-38/50

economical methods of drawing after high-frequency hardening are interrelated with the hardening temperature and with the heating rate in the region of phase transformations. There are 4 figures, 1 table, and 3 Soviet references.

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED: May 29, 1958

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18(3), 18(7)

AUTHOR: Kidin, I. N. SOV/163-59-1-40/50

TITLE: Kinetics of the Induction Heating of Pearlite Cast Iron (Kinetika induktsionnogo nagreva perlitnogo chuguna)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1959. Nr 1, pp 206-213 (USSR)

ABSTRACT: B. G. Belyakov, Engineer, assisted in the experiment of which this report gives an account. Reference is made to papers by the author (Refs 1, 2, 3, 4) published within the last 6 years. They include a systematic investigation of the kinetics of the induction heating of iron and steel. The results obtained by these studies are briefly summarized. The predominant kink in the heating curve is caused by the occurrence of a pervading paramagnetic layer at the surface of the heated object at certain temperatures. In particular the transformation of the surface layer from the ferromagnetic to the paramagnetic state must be made responsible for the change of temperature increase during induction heating. Phase transformations play only a subordinate role. In this paper the kinetics of the induction heating of pearlite cast iron was investigated. The method of temperature measurement, the recording of the heating curve and

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the control of the process has been described in another paper by the author (Ref 2). The experiments showed that similar to the heating of steel even here the rate of heating in the first stage differs greatly from that of the final stage. In the second stage the rate is reduced almost by a factor of 20. The second important result of these experiments is the substantiation of the fact that the temperature at the kink of the heating curve is connected with the temperature of magnetic transformation in the ferromagnetic phase of cast iron. At heating rates of 2,000 degrees per second the main kink is found at 770°, at higher rates at higher temperatures, up to 790°. The third important result is as follows: In contrast with steel, there was in no cases found a temperature reduction at the kink in heating cast iron samples. This is explained by the different thermal conductivity of steel and cast iron. The physical cause for the appearance of the kink, that is, the modifications in the electromagnetic system at the transformation of the surface layer of the heated sample from the ferromagnetic into paramagnetic state, in this case also applies to cast iron. As is the case with steel also with cast iron the modification of

the conditions of heat transfer plays an important role. The diagrams obtained substantiate this assumption. The experiments provided a direct proof of the fact that the thermal effect of the pearlite-austenite transformation has no essential influence upon the kinetics of induction heating. They also proved that if the halting temperature is near the temperature of transformation and if no disturbance of the phase equilibrium exists, no critical point is found in the heating curve due to this transformation. Hence the kinetics of the induction heating of cast iron exhibits a character similar to that found for steel. There is only one difference, namely that with cast iron one of three types of the time course of heating is missing and only two types are found: 1) A critical point in the heating curve. 2) A retardation of the temperature increase above this critical point. There are 6 figures and 4 Soviet references.

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000722510018-5"

18 (3), 18 (7) SOV/163-59-2-29/48

AUTHORS: Kidin, I. N., Shtremel', M. A.

TITLE: The Strengthening of Alloys by Accelerated Heating (Uprochneniye splavov putem uskorennogo nagreva)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1959, Nr 2, pp 165-172 (USSR)

ABSTRACT: The strengthening of many iron alloys low in carbon (with Cu, Ni, Mn, etc) is done by hardening, a hard surface layer forming by a γ-α-conversion. In the papers published in 1956-57 (Refs 1, 2), a new phenomenon was described, namely the additional strengthening of these alloys by accelerated heating and an α-γ-conversion. At present, the influence of the heating rate within 50-2500 degrees/sec on the fine structure and the strengthening of chromium- and nickel-iron alloys has been investigated. The results are represented in figure 1. Besides the heating rate, also the temperature of hardening and the quenching medium (oil, water, 10% soda lye at 5°) were varied. The stresses of second kind (σ_{II}) and the block size (D_{bl}) were determined according to L. S. Moroz by measuring the width of two lines of an X-ray picture.

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The Strengthening of Alloys by Accelerated Heating SOV/163-59-2-29/48

Figure 1 shows that the hardness increases more rapidly at an accelerated cooling than at an accelerated heating. In spite of this, the accelerated cooling offers no advantages due to technical difficulties. The accelerated heating leads to a splintering of the blocks. Figure 3 shows the dependence of the hardness on $\frac{1}{\sqrt{D_{bl}}}$ at different variations of heat treatment. The problem as to whether the hardening by cold working follows the same rules has not yet been solved. The experimental results of M. D. Perkas (Ref 7) represented in figure 4 point to a different character of the two hardening processes. Some features of the mechanism of phase hardening, which distinguish it from the hardening by cold working, are subsequently described. The hardening by a phase conversion is a regular three-axis plastic deformation. It proceeds uniformly in each volume element by consecutive thrusts with intermediate rests. The higher effect of accelerated heating is explained by the fact that more core of the γ-phase are simultaneously formed, thus producing a finer structure. There are 5 figures and 12 references, 10 of which are Soviet.

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The Strengthening of Alloys by Accelerated Heating SOV/163-59-2-29/48

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED: November 21, 1958

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PHASE I BOOK EXPLOITATION SOV/4782

Moscow. Institut stali

Proizvodstvo i obrabotka stali i splavov (Production and Treatment of Steel and Alloys) Moscow, Metallurgizdat, 1960. 462 p. (Series: Its: Sbornik, 39) 2,100 copies printed.

Ed.: Ye. A. Borko; Ed. of Publishing House: S. L. Zinger; Tech. Ed.: M. R. Kleynman; Editorial Council of the Institute: M. A. Glinkov, Professor, Doctor of Technical Sciences; R. N. Grigorash, Docent, Candidate of Technical Sciences; V. P. Yelyutin, Professor, Doctor of Technical Sciences; A. A. Zhukhovitskiy, Professor, Doctor of Chemical Sciences; I. N. Kidin, Professor, Doctor of Technical Sciences; B. G. Livshits, Professor, Doctor of Technical Sciences; A. P. Lyubimov, Professor, Doctor of Technical Sciences; I. M. Pavlov, Corresponding Member, Academy of Sciences USSR; and A. N. Pokhvisnev, Professor, Doctor of Technical Sciences.

PURPOSE: This book is intended for technical personnel in industry, scientific institutions and schools of higher education, dealing with open-hearth and electric-furnace steelmaking, metal rolling, physical metallurgy, metallography, and heat-treatment. It may

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also be used by students specializing in these fields.

COVERAGE: The book contains results of theoretical and experimental investigations of metallurgical and heat-engineering processes in open-hearth and electric furnaces. Data are included on the following: desulfurizing of pig iron outside the blast furnace, interaction of oxides of the carbide-forming metals with solid carbon, the change of content of gases in the bath of the open-hearth furnace in various periods of melting, intensification of the electric melting of steel, etc. Other articles deal with the nonuniformity of deformation in rolling, the study of the continuous rolling process, the dependence of the friction-slippage coefficients in rolling on a number of factors, and other problems in the pressworking of metals. Articles on physical metallurgy and the theoretical principles and techniques of the heat treatment of steel are also included. No personalities are mentioned. References accompany most of the articles. There are 207 references, both Soviet and non-Soviet.

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KIDIN, I.N.

KIDIN, I.N., doktor tekhn.nauk; BASHNIN, Yu.A., kand.tekhn.nauk; LECHIKEVICH, K.S., inzh.

Kinetics of the isothermal transformation of austenite in roller bearing steel prepared with use of induction heating. Sbor.Inst.stali no.39:284-296 '60. (MIRA 13:7)

1. Kafedra metallovedeniya i termicheskoy obrabotki Moskovskogo ordena Trudovogo Krasnogo Znameni instituta stali im. I.V. Stalina.
(Steel--Metallography) (Induction heating)

KIDIN, I.N., doktor tekhn.nauk

Dependence of carbon concentration in the solid solution of tungsten steel on induction heating parameters. Sbor.Inst. stali no.39:315-324 '60. (MIRA 13:7)

1. Kafedra metallovedeniya i termicheskoy obrabotki Moskovskogo ordena Trudovogo Krasnogo Znameni instituta stali im. I.V. Stalina.
(Tungsten steel--Metallography)
(Induction heating)

KIDIN, I.N., doktor tekhn.nauk

Dependence of carbon concentration in a solid solution of molybdenum steel on induction heating parameters. Sbor.stali no.39:337-344 '60. (MIRA 13:7)

1. Kafedra metallovedeniya i termicheskoy obrabotki Moskovskogo ordena Trudovogo Kras nogo Znameni instituta stali im. I.V. Stalina.
(Iron-molybdenum alloys--Metallography)

25732
S/123/61/000/012/016/042
A004/A101

1.1710

AUTHOR: Kidin, I. N.

TITLE: On the causes of improved properties of ferro-alloys after h-f hardening

PERIODICAL: Referativnyy zhurnal, Mashinostroyeniye, no. 12, 1961, 82, abstract 12B586 (V sb. "Metallovedeniye i term. obrabotka metallov". [Tr. Sektsii metalloved. i term. obrabotki metallov. Tsentr. pravl. Nauchno-tekhn. o-va mashinostroit. prom-sti, no. 2]. Moscow, 1960, 25-38)

TEXT: The process being carried out in the right way, h-f hardening makes it possible to obtain better mechanical properties of steels than after ordinary hardening. An improvement of the properties is attained in consequence of special condtions under which the phase transformation process is taking place during rapid induction heating. The factors improving the steel properties are the following: obtaining a finer-grained austenite during hardening and, consequently, a finer crystalline martensite after hardening; non-homogeneity of carbon concentrations in individual martensite crystals and in larger microzones accord-

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A004/A101

On the causes of improved properties ...

ing to the space arrangement of the structural constituents in the initial state; additional breaking-up of mosaic blocks in the hardened state caused by the limiting of the austenite block growth, because of the reduced time interval during which the transforming volume exists in the austenitic state. There are 14 figures and 15 references.

N. Il'ina

[Abstracter's note: Complete translation]

Card 2/2

KIDIN, I.N.

Effect of the cooling medium on the fine structure of induction-heated chromium iron. Izv. vys. ucheb. zav.; chern. met. no.1:142-146 '60. (MIRA 13:1)

1. Moskovskiy institut stali.
(Chromium steel--Metallography) (Induction heating)

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77702
SOV/148-60-1-25/34

AUTHORS: Kidin, I. N., Bashnin, Yu. A.

TITLE: Isothermal Austenite Transformation at Induction Heating of Tool Steel

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1960, Nr 1, pp 147-151 (USSR)

ABSTRACT: The authors, assisted by Eng. L. F. Kharitonova, studied the effect of conventional or retarded furnace heating and of optimum induction heating on the kinetics of austenite decomposition in overcooled state in three different steels (Table A). The transformation curves for steel KhG are illustrated in Fig. 2; the curves for steels 9KhS and KhVG preserve about the same form, but are shifted to the left and right, respectively. All three steels demonstrated that induction heating shifts the curves of both the formation and decomposition of austenite to the left relative to the curves for furnace heating. The respective figures reveal that induction heating accelerates austenite decomposition by 2.5 to 68 times depending on the heating temperature, heating rates, and steel

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composition. The lesser stability of the austenite formed on induction heating is believed to be the result of the higher heating rates during induction heating,

Table A. Chemical composition of steels and conditions of austenization. (A) Designation of steel; (B) chemical composition (%); (C) condition of austenization; (D) conventional heating: (E) induction heating; (t_A) heating temperature (°C); (v_Φ) heating rates (°C/sec).

A	B								C	
	C	Cr	Ni	W	Mn	Si	S	P	D	E
9KhS	0,88	1,06	0,10	—	0,52	1,38	0,010	0,016	$t_A = 900°$	$v_\Phi = 230$, $t_A = 950°$
KhG	1,43	1,46	0,11	—	0,58	0,29	0,008	0,020	$t_A = 875°$	$v_\Phi = 230$, $t_A = 925°$
KhVG	0,95	0,98	0,10	1,60	1,02	0,28	0,007	0,017	$t_A = 870°$	$v_\Phi = 230$, $t_A = 920°$

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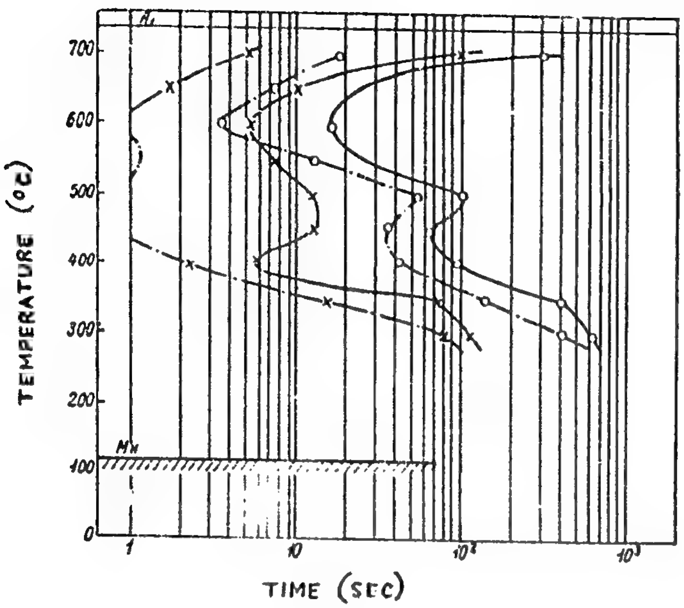

Fig. 2. Diagram showing isothermal austenite transformation in steel KhG. -.-.-. Induction heating, v_{Φ} = 230° C/sec t_A = 920° C; ———— conventional heating, t_A = 875° C.

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Isothermal Austenite Transformation at Induction Heating of Tool Steel

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due to which austenite becomes finer-grained, richer in residual carbide, and with carbon and other admixtures less regularly distributed. Each of these factors contributes in one way or another to a more rapid decomposition of austenite in overcooled state, especially above the pearlite stage. The presence of more than one carbide accelerates austenite decomposition still further. The products of austenite decomposition on induction heating proved to be softer than those produced on furnace heating. This difference is especially pronounced at temperatures from 450 to 550° C, at which the decomposition products become harder because of structure alterations at the turn from pearlite to a transitional stage. Change of the conditions under which austenization takes place can permit one to vary the hardenability of these steels. There are 4 figures; 1 table; and 5 Soviet references.

ASSOCIATION: Moscow Steel Institute (Moskovskiy institut stali)

SUBMITTED: January 12, 1959

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20281
S/148/60/000/009/018/025
A161/A030

18.7100 1413 1045

AUTHORS: Bashnin, Yu.A., and Kidin, I.N.

TITLE: The effect of induction heating on the kinetics of isothermic austenite transformation in chromium steel

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no. 9, 1960, 132-139

TEXT: Induction heating of steel alloyed with carbide-forming component not only gives finer grain and fine austenite structure but also reduces the dissolving of carbides comparing with conventional furnace heating (Ref.1,2); thist must be reflected in the kinetics of isothermic austenite transformation. The purpose of investigation was to study the effect of the carbide-forming element on the stability of austenite obtained by induction heating. Four chromium steel grades chosen (with Cr content between 1.06 and 5.03%) were melted in a small induction furnace, and annealed for grainy pearlite (initial structure for investigation). The transformation kinetics were watched with an Akulov anisometer adapted for induction heating; details of method were described in (Ref.4) (I.N.Kidin, Yu.A.Bashnin

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and K.S.Lechikevich. "Sb. truda MIS", XXXIX, 1960). A 100 kw, 350,000 cycles/sec tube generator was used for heating, with a photoelectric pyrometer. The transformation after slow heating in a furnace was also studied for comparison. The isothermic austenite transformation curves recorded in induction and common heating are given (Fig.1-4). Addition of Cr produced two sharply expressed stable austenite zones with a transition zone in between, regardless of the heating method. Contrary to the effect in carbon steel (Ref.5) austenite was less stable in induction heated steel than in furnace heated, and the temperature effect was different. Undissolved carbides had a considerable effect, and the composition of austenite varied: in steel with 0.56% C and 1.06% Cr heated with 200°C/sec to 950° the C content in martensite, and hence in austenite prior to quenching, was 0.37%. compared with 0.56% in common heating. Undissolved carbides obstruct the austenite grain growth decreasing its stability. Photomicrographs (Fig.5) show much smaller grain size after induction heating than after common. Fine-grain austenite must decompose in the pearlite phase faster than coarse-grained, and this can be seen in diagrams (Fig.1-4). For instance, decomposition of austenite in steel 0.84% C and 1.07% Cr

at 600°C starts after 1 sec during induction heating, and after 28 sec in common; at 650° the respective time is 5 and 12 sec. For steel with 0.56% C and 1.06% Cr this time is 1 sec and 36 sec at 600°, and 1.5 and 14 sec at 650°C. The same was observed at other temperatures in the pearlite range. In the transition zone the stability of austenite dropped more, which may be explained by the presence of ready centers of the new phase formation. In 300-500°C a continuous drop of hardness was stated with rising temperature, and in induction-heated steel the drop was to a lower level. Increase of Cr content from 1.06 to 4.96% at C content of 0.56 and 0.89 lead to some increase of stability of supercooled austenite regardless of the austenization method, but reduced stability of austenite formed in speeded up heating was more expressed at high Cr content. Time to start decomposition of austenite in steel with 0.58 C and 5.03% Cr at 600°C was 6 sec (in heating with 200°C/sec to 980°), and in common heating 650 sec. In the pearlitic transformation range the temperature of minimum austenite stability dropped more than in common heating. Conclusions: 1) Austenite of chromium steel formed in induction heating is less stable at subcritical temperatures than austenite formed in furnace heating, and the stability varies with transformation temperature and steel composition. 2) The kinetic of transforma-

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A161/A030

The effect of induction heating ...

tion is determined - (apart from the chemical composition) by the mode of heating. The heating mode in induction heating has more influence in the initial stages of supercooled austenite decomposition. 3) The minimum austenite stability temperature in induction heating dropped, owing to lower Cr content in austenite. 4) Hardening of the austenite decomposition products in transformation from the pearlite into the transition range was absent. This is due to reduced and uneven Cr distribution in austenite. 5) The application of induction heating drastically reduces the stability of supercooled austenite in chromium steel in the transition range. There are 7 figures and 6 Soviet-bloc references.

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED: 11 April 1960

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20255

S/148/60/000/011/012/015
A161/A030

18 6200 1497, 1521

AUTHOR: Kidin, I. N.

TITLE: Induction heating for hardening cermets

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no. 11, 1960, 113 - 120

TEXT: Cermets are mostly used without chemothermic treatment or heat treatment with slow heating in a special furnace (Ref. 6) because of the expense and insufficient effect of both methods. The investigation described in this article is the first attempt to use induction heating for heat treatment. The studied Fe-C compositions were prepared from iron powder obtained by reduction of scale and screened through a No. 15 screen (100 mesh), and pencil graphite. Specimens (15 mm in diameter and 15 mm high) were sintered in hydrogen at 1150°C with 1.5 hour holding heated using a 60 kw 250,000 cycle tube generator and quenched in water directly (without soaking) when the quenching temperature was reached. Generally speaking the surface heating process resembled the process in solid steel, i.e., it had the same first quasi-stationary period until the

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Induction heating for hardening cermets

formation of a solid paramagnetic layer (Curie point) on the surface, and a second, starting above the Curie point, but the final result was different. The hardness was much lower than in solid steel with the same C content (as in the case of the usual cermet hardening) and was similarly treated (Figure 2 and 3). At the same time, the gain in hardness of cermet through induction heating was high compared with the result of usual hardening, the hardness increased 8 - 12 R_C units (in specimens with 85 % density). Naturally, the heat conduction is different in metal with a different pores' quantity, and this must be taken into account. The maximum hardness was obtained with quenching from 1000°C when metal was heated at a rate of 80°/sec during the second period, and with quenching from 1040° and 1080° when the heating rate was 240 and 550°/sec. Peculiar "white spots" (Figure 4) in zones around the pores were studied and stated to have a considerably higher hardness than the surrounding metal. It seems that high-carbon martensite formed in the boundaries at the pores. The hardness of the background increased with the increasing speed of heating, and the hardness in the "white spots" decreased at the same time, which is apparantly due to limited diffusion processes from the pores to-

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A161/A030

Induction heating for hardening cermets

wards the metal with faster heating. It may be supposed that one of the causes is surface graphitization in the pores during the relatively slow cooling of specimens after sintering (in the refrigerator), and the high difference in electric conductivity of the pores and the metal volumes, i.e., denser current and higher heat on the surfaces of the metal particles, causing the formation of high-carbon austenite microvolumes. Further systematic study is stated to be necessary. There are 5 figures and 9 references: 5 Soviet and 4 non-Soviet-bloc. One reference is English and reads as follows: (Ref. 6) G. Stern. American Institute Mining and Metal. Engineers, 1946.

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED: August 18, 1960

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S/032/60/026/008/006/011
B015/B064

AUTHORS: Kidin, I. N., Panov, A. V., Shtremel', M. A.

TITLE: An Apparatus for Studying Isothermal Transformations by the Method of Electrical Resistance

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol. 26, No. 8, pp. 1009-1012

TEXT: The present paper describes a device that is used to study isothermal phase transformations in hardened metal samples after rapid heating up to a constant temperature (Fig. 1). Wire- and lamella samples are used, which are heated by the passage of industrial current, and then a voltage is applied with the help of a transformer, which keeps the temperature constant. At 500-600°C a constant temperature is reached in 3-6 seconds, and this temperature is maintained at ± 3 to ± 5°C exactly. Since direct measurement of resistivity on a rapid heating is complicated by the inaccuracy of the recording instruments, and ammeter and a differential voltmeter as well as a standard resistor in bridge circuit were used for this purpose. The relative change of the electrical resistance is determined from equation (6) and in consideration of the changing temperature of the

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An Apparatus for Studying Isothermal Transformations by the Method of Electrical Resistance

S/032/60/026/008/006/011
B015/B064

standard resistor and the initial temperature of the sample. The curve of the change of the electrical resistance of the ХН80 (KhN80) alloy at 545°C (Fig. 3) is given for an illustration. There are 3 figures.

ASSOCIATION: Moskovskiy institut stali im. I. V. Stalina (Moscow Steel Institute imeni I. V. Stalin)

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1710

23996
S/148/61/000/005/010/015
E111/E180

AUTHORS: Kidin, I.N. and Marshalkin, A.N.

TITLE: Investigation of the decomposition of heterogeneous martensite obtained on quenching after rapid heating

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, 1961, No.5, pp. 147-152

TEXT: Tempering of steel after induction hardening is an important subject whose specific features, particularly the heterogeneity of martensite make existing ideas on tempering after ordinary hardening inapplicable. I.N. Kidin has shown (Ref.1: Fizika metallov i metallovedeniye, V.3, No.2, 1956, 299-305) that martensite crystals developed in steel hardened after rapid heating can have a relatively high carbon content, and he has also studied the effect of heating rates on carbon distribution (Ref.2: I.N. Kidin, Fizika metallov i metallovedeniye, V.3, No.2, 1956, pp.306-308. Ref.3: I.N. Kidin, Ye.V. Astaf'yeva, Metallurgiya, 1958, No.1. Ref.4: I.N. Kidin, Ye.V. Astaf'yeva, A.N. Marshalkin, Metallovedeniye i obrabotka metallov, 1958, No.9). X-ray data for type 40 steel show that there is a maximum heterogeneity for a

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given temperature for each heating rate the heterogeneity rising with increasing heating rate. These and other (e.g. Ref.6: G.V. Kurdyumov, A. Ivenson, Zh.T.F., 1930, No.1, 41) observations show that steel subjected to definite high-frequency hardening schedules consists of a large number of martensite crystals of increased carbon concentration which do not change on cooling during quenching and of crystals of low-carbon martensite, partially decomposed with precipitation of a highly dispersed carbide phase. This structural heterogeneity of martensite introduces several peculiarities into its decomposition-kinetics. To elucidate these, dilatometric experiments have been carried out and the effects of temperature and duration of tempering on electrical resistivity and coercive force studied. 2.5-mm diameter wire test pieces of type 40 and У8 (U8) steels were used, resistance heating was applied for heating to hardening temperature. Quenching was in brine at -8 °C, followed by cooling in liquid nitrogen. A high-frequency dilatometer, of A.V. Panov design (Ref.12: I.N. Kidin, A.V. Panov, Zavodskaya laboratoriya, V.23, No.1, 1957) [Not described - Abstractor] was used, with a magnification of 3×10^4. Dilatometric curves are shown in

Fig.3 for type 40 steel after ordinary hardening from 870 °C
(circles) and after hardening from 950 °C (with rapid heating)
(squares) (abscissa in time, mins). The authors point out that
under practical conditions the differences should be even more
pronounced. The dilatometric results are confirmed by those of
measurements of resistivity changes. The differences are greater
at lower tempering temperatures. Qualitatively similar results
were obtained with type U8 steel but differences were smaller.
The decrease in tempering time or decrease in temperature for a
given time, which this investigation shows to be possible with
rapid heating to hardening temperature, is advantageous both from
the economic and steel quality aspects. The latter was studied on
several structural carbon and alloy steels. It was found that good
mechanical properties are obtained only under strictly controlled
hardening and tempering conditions. Rapid heating for hardening
gives a better combination of hardness and plasticity, probably
because of the greater extent of decomposition of the solid
solution, preservation of its heterogeneity, greater degree of
dispersion and the distribution of precipitated carbide phase.

23996

Investigation of the decomposition . . . S/148/61/000/005/010/015
E111/E180

For alloy steels the extent of alloying and distribution of alloying elements in the alpha-solution are also important. Fig.5 shows the R_c hardness and impact strength (kgm/cm²) as functions of tempering temperature for a steel with 0.6% C and 1% Cr for a tempering time of 15 minutes (град/сек = deg/sec) (Curve 1 - 170°/sec 1050°, curve 2 - 85°/sec., 1000°. curve 3 - usual tempering ; curve 4 - 40°/sec . 950°
Conditions represented by curve 1 evidently produce the optimum heterogeneity both for carbon and chromium, which in the subsequent tempering leads to better mechanical properties. Similar behaviour was observed with a 0.4% C, 4.2% W steel and other alloy steels. The authors emphasise the useful practical results from the application of induction hardening in heat treatment.
There are 5 figures and 13 references: 11 Soviet, 1 German and 1 English. The English language reference reads as follows:
Ref.8: R.H. Aborn Metal Progress, No.6, V 68, 1955.

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED: January 21, 1961

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1 1800

23997
S/148/61/000/005/011/015
E111/E180

AUTHORS: Kidin, I.N., and Andreyev, Yu.G.

TITLE: Cyaniding of steel with high-frequency heating

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, 1961, No.5, pp. 153-161

TEXT: The advantages of gas cyaniding over gas carburisation
are higher diffusion rates and a more wear-resisting surface.
I.N. Kidin (Ref.1: Metallurgizdat, 1950) has shown that the
advisability of using high-frequency heating in thermo-chemical
treatment is due solely to the higher temperatures and therefore
rates which can be obtained; e.g. at the im. Likhachev car works
its adoption enabled cementation rates to be raised tenfold.
In cyaniding, however, temperature cannot be raised without
reducing the nitrogen content of the layer. The authors report
their investigation of the possibilities of increasing cyaniding
temperatures. In the investigation type 30 and 30ХГТ (30KhGT)
steels were used. The latter is an alloy steel widely used in the
case-hardened state in the car industry. Engineer G.S. Matyuk
participated in the work. Cyaniding was carried out in a mixture

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of towns gas and ammonia flowing at 200 ml/min (2.5-30% ammonia concentration) in a laboratory installation, heating being effected from a 100-kW, 2500-cps rotary generator. The temperature was measured with a chromel-alumel thermocouple spot-welded to the specimen surface and was kept constant automatically at 800, 900, 930 and 1000 °C with holding times of one-half, one and one-and a-half hours. Cyanided specimens were cooled to 800 °C and oil quenched, giving a fully hardened cyanided layer and a troostite-martensite (30KhGT steel) or sorbite (30 steel) core. Comparative tests were carried out with cyaniding using ordinary heating and with cementation using towns gas alone and induction heating. Hardness at different depths was determined by the Vickers method with a load of 5 kg, the amount of residual austenite in the surface zone of the layer by the X-ray method, the wear resistance on an Amslet machine at a load of 75 kg. It was found that with induction heating the nitrogen content of the surface layer is 1.5-2.5 times that with ordinary heating, enabling higher temperatures to be used. The optimum ammonia content falls from 30-35 to 8-10%. When towns gas is used with ammonia the temperature should be 900-950 °C with induction heating since

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E111/E180

Cyaniding of steel with high-. .

higher temperatures lead to excessive carbon pick-up, especially with the alloy steel. Carbon contents were higher in cyanided than in carburized layers using induction heating or in cyanided ones with ordinary heating. If higher temperatures are required, the gas composition must be changed (e.g. to "endogas", then gas ammonia). Whilst in the first wear tests carburized layers had better resistance than nitrided ones (induction heating) the position was reversed if tests were repeated on the same specimens. The work confirms the advisability of using induction heating in cyaniding. Discussing the advantages of induction heating, the authors point out that here the effective atomic-nitrogen concentration at the work surface is probably much higher than with ordinary heating, since the gas reaching the surface is already largely dissociated.

There are 6 figures, 1 table and 11 references: 8 Soviet and 3 English. The English language references read as follows:

Ref. 3: A. Bramley, F. Turner. J. Iron Steel Inst., 1938.
Ref. 7: L. Taylor. J. Iron Steel Inst., V. 164, 1950, 277-284.
Ref. 9: S. Schultz. Iron Coal Trades Rev., 169, 1954, pp. 973-981.

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33991

S/148/61/000/005/011/015
E111/E180

Cyaniding of steel with high ...

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED: November 11, 1960

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26581
S/129/61/000/008/014/015
E073/E535

11700

AUTHORS: Astaf'yeva, Ye. V., Candidate of Technical Sciences, Bernshteyn, M.L., Candidate of Technical Sciences, Kidin, I.N., Doctor of Technical Sciences, Katok, A.M., Engineer and Tsypina, Ye. D., Engineer

TITLE: Strengthening of alloyed constructional steel by thermomechanical treatment

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, 1961, No.8, pp.54-56 + 2 plates

TEXT: The authors have tried out the effect of thermomechanical and thermo-mechanical-magnetic treatment of the steels 40ХІНВА (40KhlNVA) (0.39% C, 1.43% Cr, 1.59% Ni, 0.8% W) and 37ХН3А (37KhN3A) (0.40% C, 1.3% Cr, 3.9% Ni). From annealed steel, flat specimens of various thicknesses were produced, all of which were then deformed to a final thickness of 3 mm. The specimens were heated at 930-950°C for 20 min and, following that, they were hot rolled on a two-high mill or, alternatively, prior to rolling they were placed into a furnace where the temperature was maintained at 540 to 560°C (steel 40KhlNVA) or 470 to 480°C for the steel

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X

37KhN3A and held at these temperatures for 3 min. After rolling, the specimens were oil quenched. However, the specimens which were subjected to intermediate isothermal soaking were air quenched. Some of the specimens were quenched in a magnetic field produced by a solenoid and so spaced that all the specimens were under equal magnetic conditions. The field strength was low, about 1300 Oe, and therefore the influence of the thermomagnetic treatment was not fully apparent. The quenched specimens were subjected to low temperature tempering at 100 and 200°C with a holding time of 2 hours, followed by cooling in air. Prior to the experiments, the specimens were straightened and also ground along the contour and along the surface. Further experiments were carried out on specimens which prior to heating were ground and then quenched whilst inside punches. As a result of this the mechanical properties improved. Fig.3 shows the mechanical properties (HRC, σ_b, kg/mm^2, ψ, δ, % vs. degree of deformation, %) of the steel 37KhN3A after thermomechanical treatment in accordance with the following regimes: 1 - heating to 930°C, deformation (80% reduction), immediate quenching, tempering at 100°C; 2 - same as (1) except that tempering

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Strengthening of alloyed ... S/129/61/000/008/014/015
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was at 200°C; 3 - heating to 930°C followed by cooling down to 470°C, deformation and tempering at 100°C; 4 - same as (3), tempering at 300°C. For comparison the appropriate values obtained by ordinary heat treatment are shown by a horizontal line with a shaded area (at the left-hand side of the plot). The following conclusions are arrived at:

1. After thermomechanical treatment both steels showed stable UTS values of 245-255 kg/mm^2 with relative contractions of 25-30%.
2. The high mechanical properties after thermomechanical treatment are attributed to the high degree of dispersion and also to the fact that some structural elements are oriented.
3. From the technological point of view, the thermomechanical treatment with forming at temperatures above Ac_3 are favourable; such treatment yields an optimum combination of strength and ductility.
4. Application of a magnetic field during austenite-martensite transformation leads to more uniform mechanical properties and a slight increase in strength.

There are 3 figures and 2 Soviet references.

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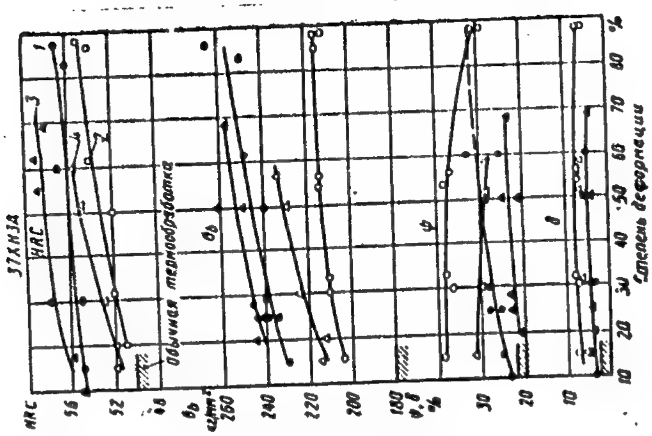
26581
Strengthening of alloyed ... S/129/61/000/008/014/015
E073/E535

Fig.3



Card 4/4

S/148/61/000/011/012/018
E111/E480

AUTHORS: Bashnin, Yu.A., Kidin, I.N.

TITLE: The effect of induction-heating conditions on the kinetics of the isothermal transformation of austenite in type 40X (40Kh) and 40XH (40KhN) steel

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no.11, 1961, 143-151

TEXT: Heating with high-frequency currents is widely used in heat treatment. To find whether induction heating can be used for isothermal treatment of steel, the kinetics and mechanism of the decomposition of austenite obtained with rapid heating must be studied. The authors have previously shown that with many steels such austenite is less stable and impairs the hardenability of the steel. For the present work, the two steels most widely used in heat treatment with induction heating were selected. Their compositions are - 40Kh steel: 0.38% C, 0.90% Cr, 0.13% Ni, 0.31% Si, 0.76% Mn, 0.023% S, 0.037% P; and 40KhN: 0.40% C, 0.67% Cr, 1.33% Ni, 0.24% Si, 0.67% Mn, 0.022% S, 0.014% P. The kinetics of the isothermal transformation of supercooled austenite were studied magnetically, with an Akulov anisometer

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APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000722510018-5"

The effect of induction-heating ... S/148/61/000/011/012/018
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adapted for induction-heating conditions. A 100 kW, 350000 cps generator was used. Details of the experimental methods have been described previously (Ref.3: I.N.Kidin, Yu.A.Bashnin, K.S.Lechikevich. Sbornik trudov Moskovskogo instituta stali. XXXIX, 1960). The experimental conditions permitted the study of the influence of austenizing temperature with ordinary and induction heating, and of steel composition on the stability of supercooled austenite and on the mechanical properties of the decomposition products. L.A.Shmeleva participated in the experimental work. It was found that with ordinary heating of 40Kh steel, the stability of supercooled austenite was increased with increasing temperature from 850 to 950°C. The same holds for other temperatures in the pearlitic region. This is due to the increasing austenite grain size and carbon and chromium concentration produced by increased temperatures in the austenitic range. The effect is particularly pronounced at 300°C. The introduction of nickel (type 40KhN steel) increases stability in the pearlite and intermediate region, increase in temperature from 820 to 950°C increases the stability of the austenite. As in
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40Kh steel, there is a marked drop in hardness of the decomposition products at 500°C. When induction heating is used, giving heating rates of up to 120 and 225°C/sec, the stability of supercooled austenite falls greatly in both steels (e.g. a fourfold and sixfold increase in decomposition rate at 650°C for 40Kh steel for heating rates of 120 and 225°C/sec, respectively). Reduced stability in the pearlite region is due to the lower carbon and chromium concentrations in the austenite, their non-uniform distribution and the smaller austenite grain size. Undissolved carbide is an important factor in the acceleration of austenite decomposition with the conditions used. Changes in austenite fine structure on indirect heating, caused by a change in transformation mechanism, also contributes to the higher decomposition rate as compared with that on ordinary heating. The higher the rate of induction heating to the constant temperature, the more heterogeneous (as regards carbon and alloying elements) is the austenite formed; consequently, the martensite-transformation range is extended in both directions when induction heating is used. The low austenite stability observed at 300°C is attributed to the

presence of microvolumes with carbon contents that determine the starting temperature for the martensite transformation. From the effects of the isothermal holding temperature and the conditions of heating in the austenitic range on the hardness of decomposition products it is evident that the higher the heating rate to the constant temperature, the less distinct the transition from the pearlitic to the intermediate region: at a heating rate of 225°C/sec, the hardness drop in nickel steel at 500°C, characteristic of slower rates, is absent and there is only a retardation in the hardness increase. There are 6 figures, 1 table and 7 Soviet-bloc references.

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED: June 6, 1961

KIDIN, I.N.; MARSHALKIN, A.N.

Investigating the decomposition of nonhomogenous martensite obtained during hardening from a quick heating. Izv.vys.ucheb.zav.; chern.met. 4 no.5:147-152 '61. (MIRA 14:6)

1. Moskovskiy institut stali.
(Steel--Metallography) (Induction hardening)

KIDIN, I.N.; ANDREYEV, Yu.G.

Cyaniding of steel with heating by high-frequency currents. Izv.vys. uchab.zav.; chern.met. 4 no.5:153-161 '61. (MIRA 14:6)

1. Moskovskiy institut stali.
(Case hardening) (Induction heating)

KIDIN, I.N.; SHTREMEL', M.A.

Kinetics of changes of short-range order in binary alloys. Fiz. met. i metalloved. 11 no. 5:641-649 My '61. (MIRA 14:5)

1. Moskovskiy institut stali imeni I.V. Stalina.
(Crystal lattices—Defects)

KIDIN, I.N.; PAISOV, I.V.; BELYAKOV, B.G.; LIZUNOV, V.I.

Heat treatment of bore rods made of U7 and 55C2 steel. Izv.vys. ucheb.zav.; chern.met. 4 no.9:138-142 '61. (MIRA 14:10)

1. Moskovskiy institut stali.
(Tool steel--Heat treatment) (Rock drills)

S/129/62/000/009/002/006
E193/E383

AUTHORS: Kidin, I.N., Doctor of Technical Sciences Professor, Shtremel', M.A. and Ryl'nikov, V.S., Engineers

TITLE: Phase-transformations as means of improving the strength of iron-chromium alloys

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, no. 9, 1962, 8 - 15

TEXT: This article is concerned with hardening due to $\gamma \rightarrow \alpha$ transformation in "carbon-free" iron-base alloys, i.e. alloys containing such a small proportion of carbon (0.03 - 0.05%) that it affects neither the temperature nor the kinetics and mechanism of the $\alpha \rightleftarrows \gamma$ transformation. A large amount of published data, both Soviet and foreign, is discussed and it is concluded that the considerable increase in strength of alloys of this type (e.g. alloy 03X5 (03Kh5) containing 0.026% C, 4.98% Cr, 0.22% Si, 0.4% Mn and 0.27% Ni) brought about by quenching and ageing at 200 - 300 °C is associated mainly with the first stage of polygonization. It is pointed out that although the increase in strength due to work-hardening and due
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to $\gamma \rightarrow \alpha$ transformation is approximately the same, quenched alloys retain their strength at higher temperatures than cold-worked materials. This is due to the basic difference between the fine structure of quenched and cold-worked material: the phase transformation-induced deformation brings about uniform distribution of dislocations in the volume of the alloy and among all the systems of slip; the boundaries of the resultant fragments consist of dislocations of various types which, consequently, have low mobility and cannot readily transform into more mobile grain boundaries. This difference is reflected in the relaxation stability of quenched and cold-worked alloys, as demonstrated in Fig. 4, which shows the relaxation curves (stress, kg/mm² versus log time, min) for alloy 03Kh15 (graph a) and alloy 04X5C (C4Kh55) (graph б), the various curves relating to specimens subjected to the following treatments: 1) quenching; 2) quenching plus annealing at 500 °C; 3) 70% reduction in rolling; 4) rolling followed by annealing at 500 °C. The relaxation stability of quenched Cr-bearing ferritic alloys at 400 °C (under a stress of 40 kg/mm²) is not lower than that of pearlitic steels. Similarly, the stress
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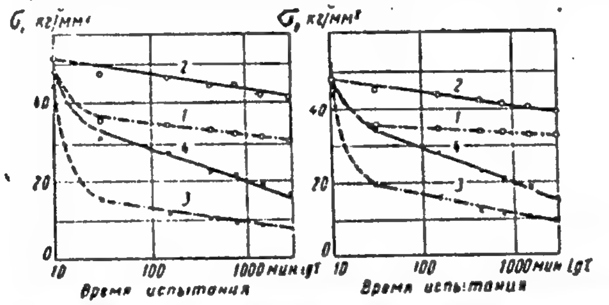
causing rupture of the 02XMФБ (02KhMVB) alloy at 500 °C in 1 000 hours is 46 kg/mm², as compared with 42 - 44 kg/mm² for the pearlitic steel ЭИ415 (EI415). This indicates that side-by-side with studies of pearlitic steels with high relaxation stability at elevated temperatures, it would be desirable to explore the possibility of developing similar alloys based on highly alloyed, carbon-free martensite. There are 6 figures and 1 table.

ASSOCIATION: Moskovskiy institut stali i splavov (Moscow Institute of Steel and Alloys)

Fig. 4:



KIDIN, I.N.

Conditions of the induction heat treatment of rapid steel.
Izv. vys. ucheb. zav.; chern. met. no.2:112-117 '60. (MIRA 15:5)

1. Moskovskiy institut stali.
(Tool steel--Heat treatment)
(Induction heating)

BASHNIN, Yu.A.; KLEIN, I.M.

Effect of the conditions of induction heating on the kinetics of isothermal transformations of austenite in 40Kh and 40KhN steel. Izv. vys. ucheb. zav.; chern. met. 4 no.11:143-151 '61. (MIRA 14.12)

1. Moskovskiy institut stali.

(Chromium steel--Metallography)
(Phase rule and equilibrium)
(Induction heating)

BASHNIN, Yu.A.; KIDIN, I.N.; KAL'NER, V.D.

Effect of induction heating on the mechanical properties of undercooled austenite decomposition products. Izv. vys. ucheb. zav.; chern. met. 5 no.7:158-164 '62. (MIRA 15:8)

1. Moskovskiy institut stali i splavov.
(Steel, Stainless—Metallography) (Induction hardening)

KIDIN, I.N.; MARSALKIN, A.N. [Marshalkin, A.N.]

Mechanism of perlite-austenite transformation in rapid heating. Analele metalurgie 16 no.4:88-95 O-D '62.

ALFEROVA, N.S., doktor tekhn. nauk; BERNSHTEYN, M.L., kand. tekhn. nauk; BLANTER, M.Ye., doktor tekhn. nauk; BOKSHTEYN, S.Z., doktor tekhn.nauk; VINOGRAD, M.I., kand. tekhn.nauk; GAMOV, M.I., inzh.; GELLER, Yu.A., doktor tekhn. nauk; GOTLIB, L.I., kand. tekhn. nauk; GRDINA, Yu.V., doktor tekhn.nauk; GRIGOROVICH, V.K., kand. tekhn. nauk; GULYAYEV, B.B., doktor tekhn. nauk; DOVGALEVSKIY, Ya.M., kand. tekhn. nauk; DUDOVTSEV, P.A., kand. tekhn. nauk [deceased]; KIDIN, I.N., doktor tekhn. nauk; LEYKIN, I.M., kand. tekhn. nauk; LIVSHITS, B.G., doktor tekhn. nauk; LIVSHITS, L.S., kand.tekhn. nauk; L'VOV, M.A., kand. tekhn. nauk; MEYERSON, G.A., doktor tekhn. nauk; MINKEVICH, A.N., kand. tekhn. nauk; NATANSON, A.K., kand. tekhn. nauk; NAKHIMOV, A.M., inzh.; NAKHIMOV, D.M., kand. tekhn. nauk; OSTRIN, G.Ya., inzh.; PANASENKO, F.L., inzh.; SOLODIKHIN, A.G., kand. tekhn.nauk; KHIMUSHIN, F.F., kand. tekhn. nauk; CHERNASHKIN, V.G., kand. tekhn. nauk; YUDIN, A.A., kand. fiz.-mat. nauk; YANKOVSKIY, V.M., kand. tekhn. nauk; RAKHSHTADT, A.G., red.; GORDON, L.M., red. izd-va; VAYNSHTEYN, Ye.B., tekhn. red.

(Continued on next card)

ALFEROVA, N.S.---- (continued) Card 2.

[Metallography and the heat treatment of steel]Metallovedenie i termicheskaia obrabotka stali; spravochnik. Izd.2., perer. i dop. Pod red. M.L.Bernshteina i A.G. Rakhshtadta. Moskva, Metallurgizdat. Vol.2. 1962. 1656 p. (MIRA 15:10)

(Steel--Metallography)
(Steel--Heat treatment)

KIDIN, I.N., doktor tekhn.nauk, prof.; SHTREMEL', M.A., inzh.; RYL'NIKOV, V.S., inzh.

Precipitation hardening of iron-chromium alloys. Metalloved. i term. obr. met. no.9:8-13 S '62. (MIRA 16:5)

1. Moskovskiy institut stali i splavov.
(Iron-chromium alloys--Hardening)

KIDIN, I.N. (Moskva); SHTREMEL', M.A. (Moskva)

Effect of residual stresses and the inhomogeneity of the material on its resistance to small plastic deformations. PMTF no.6:94-97 N-D '62. (MIRA 16:6)

(Deformations (Mechanics))

KIDIN, I.N.; SHTREMEL', M.A.

Conditions for the formation of boundaries with large disorientation angles. Kristallografiia 7 no.6:899-902 N-D '62. (MIRA 16:4)

1. Moskovskiy institut stali.
(Crystallization)

KIDIN, I.N.; SHTREMEL', M.A.; GRUZDOV, A.P.

Kinetics of electric resistance changes in the nickel-chromium solid solution. Izv. vys. ucheb. zav.; chern. met. 6 no.11: 186-193 '63. (MIRA 17:3)

1. Moskovskiy institut stali i splavov.

S/0129/64/000/003/0053/0057

ACCESSION NR: AP4020250

AUTHOR: Kidin, I. N.; Andryushechkin, V. I.

TITLE: Diffusion of chromium out of a galvanized layer into iron and steel during high speed electric heating

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 3, 1964, 53-57

TOPIC TAGS: induction heating, chrome diffusion, armco iron, galvanic chrome-plating, steel, heating rate

ABSTRACT: Recognizing the need for an accelerated induction heating and steel impregnation with metals, the authors studied the effect of the heating rate on the diffusion of chrome in Armco iron (0.02% C), No. 45 steel (0.47% C) and U8 steel (0.82% C). Rods were rolled into 0.5 mm thick strip and 80 x 0.5 x 5 mm specimens cut out. The structure was stabilized by vacuum annealing at 1000 C (Armco iron), 860 C (45 steel) and 760 C (U8 steel) for 90 minutes. Then, the specimens were treated by galvanic chromizing until the layer thickness amounted to 30-40 microns. By increasing the heating from 10 C/min to 3000 C/sec the depth of the penetration of chromium atoms is increased 2 to 3 times for iron and 4 to

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ACCESSION NR: AP4020250

6 times for steel. The accelerating effect of a highspeed heating process is the more conspicuous the higher its temperatures. The authors, therefore, recommend high temperatures in accordance with an increase in the heating rate. In carrying out diffusion processes without a holding period or with a short holding period (0.5 min) high-speed heating should only be applied above 1100 to 1150 C because the diffusion process is more complete below this temperature range under conditions of a gradual heating. $Cr_{23}C_6$ was not observed after the diffusion of chrome in 45-type and U-8 type steel at a high heating rate. The authors assume that the effect of the heating rate on the diffusion of chrome in iron and steel may be attributed to the peculiarities of the structural state of austenite as it forms during rapid heating. Orig. art. has: 3 figures.

ASSOCIATION: Moskovskiy institut stali i splavov (Moscow Institute of Steel and Alloys)

SUBMITTED: 00 DATE ACQ: 31Mar64 ENCL: 00

SUB CODE: MM NO REF SOV: 008 OTHER: 002

Card 2/2

L 22507-65 EWT(m)/EWA(d)/T/EWP(t)/EWP(b) ASD(a)-5/ASD(f)-3/ASD(m)-3/
AS(mp)-2 JD/JW/MLK

ACCESSION NR: AT4046817 S/0000/64/000/000/0057/0062

AUTHOR: Zakharov, Ye. K.; Kidin, I.N.; Khayutin, S.G.

B+1

TITLE: Stress relaxation during the rapid heating of a metal

SOURCE: AN SSSR. Nauchny*y sovet po probleme zharoprochny*kh splavov. Issledovaniya staley i splavov (Studies on steels and alloys). Moscow, Izd-vo Nauka, 1964, 57-62

TOPIC TAGS: stress relaxation, elastic deformation, plastic deformation, alloy elasticity, Maxwell equation, nichrome alloy, activation energy, alloy recrystallization

ABSTRACT: Stress relaxation was studied in hardened, cold-worked and annealed nichrome. The relaxation curves of annealed nichrome reveal a continuous increase in relaxation speed with increased temperature, particularly between 400 and 500C. There are two stages of relaxation in annealed nichrome: low-temperature relaxation with an activation energy of 850 cal/mole, and high-temperature relation with an activation energy of 7500 cal/mole. These energy values are low because, during rapid heating, only those processes requiring a minimum activation temperature can play a role. The relaxation curves of hardened samples show that from room temperature to 100C the relaxation speed is increased, from 200-300C, the relaxation speed falls off to zero, and above 300C, the relaxation speed quickly increases. During the heating of cold-worked nichrome, relaxation is

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ACCESSION NR: AT4046817

initially more rapid than in hardened and annealed samples. Afterwards, the speed is sharply decreased, but above 500C, the values are increased by 100-200%. The heating speed of cold worked nichrome has little effect on relaxation. The processes of recrystallization and order-disorder transformation occur with enormous speed in both hardened and cold-worked alloys, and are realised to an essentially equal degree at all the investigated heating speeds. Orig. art. has: 3 figures and 13 formulas.

ASSOCIATION: None

SUBMITTED: 16Jun64 ENCL: 00 SUB CODE: MM

NO REF SOV: 002 OTHER: 000

Card 2/2

L 24412-65 EPA(s)-2/EWT(m)/EPF(n)-2/EWA(d)/EWP(t)/EWP(k)/EPA(bb)-2/EWP(b)
Pf-4/Pt-10/Pu-4 IJP(c)/ASD(f)-2/ASD(m)-3 MJW/JD/HW/JG/MLK

ACCESSION NR: AT4046028 S/0000/64/000/000/0118/0120

AUTHOR: Yezhov, I. A.; Zakharov, Ya. K.; Kidin, I. N.

TITLE: Investigation of the rupture life of cold-strained tungsten and its alloy with molybdenum at temperatures above 1400C

SOURCE: AN SSSR. Nauchny*y sovet po probleme sharoprochny*kh splavov. Issledovaniya staley i splavov (Studies on steels and alloys). Moscow, Izd-vo Nauka, 1964, 118-120

TOPIC TAGS: tungsten, VRN tungsten molybdenum alloy, VM50 alloy rupture life, high temperature rupture life, refractory VM50 alloy, VM50 alloy ductility

ABSTRACT: VRN tungsten and a VM50 alloy (a substitutional-solid solution containing 50 wt% W and 50 wt% Mo and with a solidus temperature of 2800C) were prepared by the powder metallurgy method, warm drawn with a 99% reduction to wires 1.0 and 0.8 mm in diameter, respectively, and subjected to a stress-rupture test at temperatures ranging from 1400 to 2800C for VRN and from 1100 to 2400C for the

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L 24412-65

ACCESSION NR: AT4046828

0

VM50 alloy. Specimens were tested in a vacuum of 10^{-4} mm Hg and heated at a rate of 100C/sec; by varying the applied stress, the rupture life was varied from 1 to 100 min. Test results showed that the 10-min rupture strength of the VM50 alloy is 4—1 kg/mm^2 lower than that of VRN tungsten. The former, however, is more ductile. This desirable combination of strength and ductility makes possible the use of the VM50 alloy as a high-temperature construction material. Orig. art. has: 2 figures.

ASSOCIATION: none

SUBMITTED: 16Jun64 ENCL: 00 SUB CODE: MM

NO REF SOV: 000 OTHER: 003 ATD PRESS: 3133

Card 2/2

ACCESSION NR: AP4039276 S/0148/64/000/005/0124/0129

AUTHORS: Kidin, I.N.; Shtremel', M.A.; Chizhikov, V.Yu.

TITLE: Work hardening of a Ni-Cr solid solution during tempering

SOURCE: IVUZ. Chernaya metallurgiya, no. 5, 1964, 124-129

TOPIC TAGS: work hardening, solid solution, Ni, Cr, plastic deformation electrical resistivity, Suzuki segregation, recovery

ABSTRACT: The authors observed the effect of the changes in the resistance to small plastic deformations on the transformation in the Ni-Cr solid solution. The 100 x 2.5 x 0.2 - 0.4 mm specimens had the following composition (% weight) : 19.82-20.08% Cr; 0.018C; 0.13-0.25 Al; 0.06-0.010 Ti; 0.08-0.25 Si; 0.37-0.86 Fe; 0.07 Mn and 0.09 Co. Water quenching from 900C and drawing with an 88% reduction were followed by rolling the wire to a 0.4 mm strip and tempering at 400,450 and 500C for periods ranging from 5 minutes to 800 hrs. The elastic limit, HV and electrical resistivity were measured by standard methods. Electrical resistivity increases until the elastic limit is reached and, thereafter, both values change parallelly. The authors assume that the increase in the

Card 1/2

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000722510018-5"

ACCESSION NR: AP4022898 S/0148/64/000/003/0148/0153

AUTHOR: Kidin, I.N.

TITLE: Hypothesis concerning the Increased Activity ofAustenite Impregnation During Nucleation

SOURCE: IVUZ. Chernaya metallurgiya, No.3, 1964, 148-153

TOPIC TAGS: nucleation, austenite, grain size, diffusion layer, boundary extension, impregnation, Armco steel, mild carbon steel

ABSTRACT: The author investigated the effect of the heating rate on the basic phase transformation and the thickness of the diffusion layer. The experimental part was carried out by A.N. Marshalkin and V.I. Andryushechkin. U-8 steel specimens heated to 785-810C showed that with an increase in temperature nucleation increased 270 times while the growth rate increased by less than 40 times. Impregnation with another element is possible with fine-grained austenite which has extensive grain boundaries so that the susceptibility to diffusion of the medium being impregnated is considerably enhanced. The proper impregnation temperature should be determined according to the tempera-

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ACCESSION NR: AP4022898

ture curve on the upper section of retardation. Thus, nucleation would occur in the basic mass of the heated volume and a substantial growth of the centers would be avoided. This type of austenite would be highly active with regard to diffusion susceptibility. The author initiated a series of tests for the purpose of producing austenite with different boundary extensions during isothermal transformation. Thin, chrome-plated annealed Armco-iron (0.02%C), "45" type steel (0.47%C) and U8-type steel specimens were heated to 930-1300C and subjected to isothermal holding for 0.5, 2,5 and 10 minutes. The resultant thickness of the diffusion layer was highest in Armco iron specimens reaching 145 microns after heating to 1140C at a rate of 3000C/sec and a ten-minute holding period. At 3000C/sec the smallest grain size and the longest austenitic grain boundaries were observed. The author points out that heating to lower temperatures produces thicker diffusion layers at a slow heating rate while heating to higher temperatures yields thicker layers at higher heating rates. However, further study of diffusion phenomena at high reating rates, effects of grain boundaries and mosaic blocks, and of boundaries as suppliers of vacant sites are recommended. Orig. art. has 4 figures.

Card 2/3

ACCESSION NR: AP4022898

ASSOCIATION: Moskovskiy institut stali i splavov (Moscow Institute of Steel and Alloys)

SUBMITTED: 16Nov63 DATE ACQ: 10Apr64 ENCL: 00

SUB CODE: ML NO REF SOV: 004 OTHER: 003

Card 3/3

KIDIN, I.N.; MOZZHUKHIN, Ye.I.; TSEPAYEV, V.A.; CHERNYAVSKIY, K.S.

Kinetics of the induction heating of porous iron. Izv. vys. ucheb. zav.; chern. met. 7 no.1:152-156 '64. (MIRA 17:2)

1. Moskovskiy institut stali i splavov.

KIDIN, I.N.

Hypothesis of increased activity in the process of saturating austenite in the state of nucleation. Izv. vys. ucheb. zav.; chern. met. 7 no.3:148-153 '64. (MIRA 17:4)

1. Moskovskiy institut stali i splavov.

KIDIN, I. N.; SHTREMEL', M. A.; CHIZHIKOV, V. Yu.

Hardening of a solid solution of nickel-chromium during quenching. Izv. vys.ucheb. zav.; chern.met.7 no. 5:124-129 '64. (MIRA 17:5)

1. Moskovskiy institut stali i splavov.

KIDIN, I.N.; LIZUNOV, V.I.

Electric heat treatment of 30Kn8 steel. Izv. vys. ucheb. zav.; chern. met. 7 no.7:171-175 '64 (MIRA 17:8)

1. Moskovskiy institut stali i splavov.

KIDIN, I.N.

Difference of principles for fixing steel hardening temperatures with slow and rapid heating. Izv. vys. ucheb. zav.; chern. met. 7 no.9:127-130 '64. (MIRA 17:6)

1. Moskovskiy institut stali i splavov.

ACCESSION NR: AP4042548 S/0148/64/000/007/0171/0175

AUTHOR: Kidin, I. N., Lizunov, V. I.

TITLE: Electrical heat treatment of 30Kh8 steel

SOURCE: IVUZ. Chernaya metallurgiya, no. 7, 1964, 171-175

TOPIC TAGS: heat treatment, electrical heat treatment, steel hardening, steel annealing, steel tempering, steel strength, alloy steel strength, induction heat treatment

ABSTRACT: The strength of steel alloys may be increased in comparison with the usual methods by induction heat treatment with correct timing of hardening and tempering. The authors therefore investigated the effect of electrical heat treatment on the properties of 30Kh8 steel. The 8 x 20 mm sample sheets from an induction furnace were hot rolled to a thickness of 2 mm and annealed for 2 hours at 700C. Further vacuum annealing of 0.4 x 5.0 x 110 mm samples for 1 hour at 900C resulted in a regular perlite-ferrite structure. The samples were heated by the contact method while the temperature was measured by a chromel-alumel thermocouple. The results of tests after the usual and electrical methods

ACCESSION NR: AP4042548

of heat treatment are compared in Fig. 1 of the enclosure. The sharp drop in hardness for electrical heat treatment after tempering above 400C is caused by rapid redistribution of chromium, by further lowering of the C concentration in the solid solution and by carbide coagulation. The change in specific electrical resistance depending on tempering conditions also shows that the martensite structure changes insignificantly at temperatures below 400C. Rapid disintegration of the solid solution above 400C results in a sharp drop in specific electrical resistance. Similar results were obtained when measuring the elastic limit. Below 300C the variations were connected with polygonization processes caused by thermal plastic deformations with stress relaxation in the stressed martensite formed during hardening. On the basis of the test results, electrical heat treatment improves the properties of 30Kh8 steel in comparison with the usual hardening process. For optimal results, a low short-time tempering process (at 100C for 30 minutes) is needed. The hardness improves by 6-8 HRC, and the elastic limit is 10-15 kg/mm^2 higher than after the usual heat treatment (furnace hardening, 400C tempering for 1 hour). Orig. art. has: 8 figures.

ACCESSION NR: AP4042548

ASSOCIATION: Moskovskiy institut stali i splavov (Moscow Steel and Alloy Institute)

SUBMITTED: 03Dec63 ENCL: 01

SUB CODE: MM NO REF SOV: 007 OTHER: 000

Card 3/4

ACCESSION NR: AP4042548 ENCLOSURE: 01

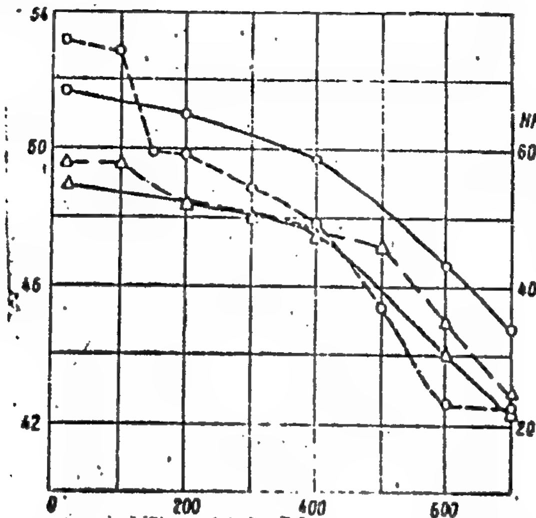

Fig. 1. Features of 30Kh8 steel after tempering:

----------usual hardening, - - - - - - - - electrical hardening, 0 hardness, Δ specific electrical resistance, Abscissa = Tempering temperature, °C.

Card 4/4

L 41142-65 EWT(m)/T/EWP(t)/EWP(b)/EWA(c) JD
ACCESSION NR: AP4049073 S/0148/64/000/011/0174/0179

AUTHOR: Kidin, I. N.; Andryushechkin, V. I.; Maslenkov, S. B.; Yegorshina, T. V.

TITLE: Concentration gradients after saturation by chromium during rapid heating 16 15 B

SOURCE: IVUZ. Chernaya metallurgiya, no. 11, 1964, 174-179

TOPIC TAGS: chromium diffusion, chromium saturation, galvanic chromium coating, clad iron, clad steel

ABSTRACT: The diffusion of chromium from a galvanic coating into Armco iron (0.2% C) and U8 steel (0.82% C) under varying conditions of heating was studied. Preparation, heat treatment, and galvanic coating of samples with chromium was effected by methods described previously by the authors. Heating was accomplished at speeds of 10 degrees/min. in an evacuated furnace (pressure below 0.1 mm Hg) with quartz fittings, and at 50 and 3000 deg/min. in a vacuum chamber by passing an electric current of industrial frequency throug the samples. Cooling speed from the saturation temperature to 600C was constant at 90-100 deg/sec. X-ray spectral analysis of microvolumetric areas was used to measure the diffusion. The photographed patterns were compared with known x-ray patterns for all samples. A French microanalyzer was used to study a volume of 5 cubic microns with an accuracy, when Cr content was below 30%, of 3%. For the iron, the region having a 2-4%

Card 1/2

L 41142-65
ACCESSION NR: AP4049073

α-solid solution with the chromium was impervious to nitric acid. Heating at 10 deg/min. produced a layer from 5 to 55 microns thick when held for a half a minute at 1000 or 1220C. All curves showed discontinuities corresponding to the change in solubility between α and γ-phases, and these data were reaffirmed by the measurements of the microthermoelectromotive force, which demonstrated the formation of two layers which appeared at all temperatures. The α-phase is extended with increased temperature and speed of heating, but above 1200C the chromium tends toward complete solubility in the α-phase, thus diffusing completely through the α-phase. Orig. art. has: 4 graphs and 1 photomicrograph.

ASSOCIATION: Moskovskiy institut stali i splavov (Moscow Institute of Steel and Alloys)

SUBMITTED: 09Apr64 ENCL: 00 SUB CODE: MM

NO REF SOV: 012 OTHER: 002

Card 2/2

L 13052-65 EWT(m)/EWA(d)/EWP(t)/EWP(b) MJW/JD/HW/JT/MLK

ACCESSION NR: AT4046849 S/0000/64/000/000/0243/0246

AUTHOR: Doronin, I. V., Zakharov, Ye. K., Kidin, I. N.

TITLE: Dependence of the strength on rate of heating for Armco iron and 1Kh18N9T and EI-925 steels at high temperatures

SOURCE: AN SSSR. Nauchny*y sovet po probleme zharoprochny*kh splavov. Issledovaniya staley i splavov (Studies on steels and alloys). Moscow, Izd-vo Nauka, 1964, 243-246

TOPIC TAGS: steel strength, steel annealing, steel cold working/Armco iron, 1Kh18N9T steel, EI-925 steel

ABSTRACT: A vertical tensile-stress testing machine, developed at the Laboratoriya metallofizicheskikh problem termicheskoy obrabotki Moskovskogo instituta stali i splavov (Laboratory of metallophysical problems of thermal treatment, Moscow Institute of Steel and Alloys), was employed in high-temperature tests of annealed Armco iron and both annealed and cold-worked 1Kh18N9T(a) and EI-925(b) steels in an attempt to bring the test conditions closer to those actually experienced by performing materials than can be attained with the use of standard methods. Wire samples 1.5 mm in diameter and 120 mm long were heated at rates of 50, 500 and 2000C/sec. by passing a 50 cps AC current to the

L 13052-65
ACCESSION NR: AT4046849

point of rupture at 2.5, 5.0, 10.0, 15.0, 20.0, and 22.5 kg/mm^2 loads for Armco iron and (a), and at 3.75, 15, 22.5, and 30 kg/mm^2 loads for (b). The temperature and elongation were tape-recorded by an MPO-2 oscillograph, with a 60 μ-thick chromel-alumel thermocouple, and a differential extensometer-recorder, sensitive to 0.01% elongations, was used to measure small deformations. The tests yielded a rather complex and ununiform data pattern, from which it may be concluded: 1) that the greater the rate of heating, the greater the temperature of rupture and the temperature at which an elongation of 0.5% is reached in Armco iron; 2) that at high rates of heating (~200C/sec.) the temperature of 0.5% elongation is higher for annealed (a) samples than for cold-worked (a) samples; and 3) that aging and the effect of "autostrengthening" are more pronounced in (b). The data are extensively discussed. Orig. art. has: 4 figures and 1 table.

ASSOCIATION: None

SUBMITTED: 16Jun64 ENCL: 00 SUB CODE: MM

NO REF SOV: 000 OTHER: 000

Card 2/2

KILIN, I.N.; LEYKOVSKIY, K.K.; PIGUZOV, Yu.V.; FADINA, L.V.

Investigating the isothermal decomposition of austenite by the internal friction method. Fiz. met. i metalloved. 18 no.2:316-317 Ag '64. (MIRA 18:8)

1. Moskovskiy institut stali i splavov.

BAYAZITOV, M.I.; KIDIN, I.N.; PIGUZOV, Yu.V.

Diffusibility of carbon in alpha-iron. Izv. vys. ucheb. zav.; chern. met. 8 no.7:137-140 '65. (MIRA 18:7)

1. Moskovskiy institut stali i splavov.

KIDIN, I.N.; MOROZOVA, T.S.

Effect of phase relationship on kinetics of the rapid heating of iron-carbon alloys. Izv. vys. ucheb. zav.; chern. met. 8 no.7:150-154 '65.
(MIRA 18:7)

1. Moskovskiy institut stali splavov.

L 12171-66 EWT(m)/EWA(d)/T/EWP(t)/EWP(z)/EWP(b)/EWA(c) JD

ACC NR: AP6000176 UR/0148/65/000/009/0155/0157

44,55 44,55 44,55

AUTHOR: Bayazitov, M. I.; Kidin, I. N.; Piguzov, Yu. V.

44,55

ORG: Moscow Institute of Steel and Alloys (Moskovskiy institut stali i splavov)

63

B

TITLE: Effect of lattice defects on the solubility of carbon in Alpha-iron

14

SOURCE: IVUZ. Chernaya metallurgiya, no. 9, 1965, 155-157

TOPIC TAGS: lattice defect, alpha iron, carbon, solubility, internal friction, electric resistance, solid solution

ABSTRACT: To fill the gap in knowledge of the effect of dislocation density on the solubility of C at high temperatures, which is one of the factors determining proneness to aging in low-carbon steels, when rapidly cooled from these temperatures, the authors investigated the effect of various dislocation densities on the solubility of C in the lattice of α-iron at elevated temperatures. Specimens of steel containing 0.01, 0.04 and 0.15% C were subjected to dilatational strain (1 to 10% elongation) in order to produce various dislocation densities. After quenching from 600°C, the solubility of C in the lattice of α-iron was determined by investigating: internal friction, electric resistance (at liquid-nitrogen temperature) and coercive force. Findings: At 300°C the background of internal friction increases, which indicates that the hig' -temperature curve of internal friction is displaced in the direction of low temperatures for specimens deformed more than 5%, which may be attributed to the con-

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UDC: 669.111.4:620.18:539.67

2

L 12171-66

ACC NR: AP6000176

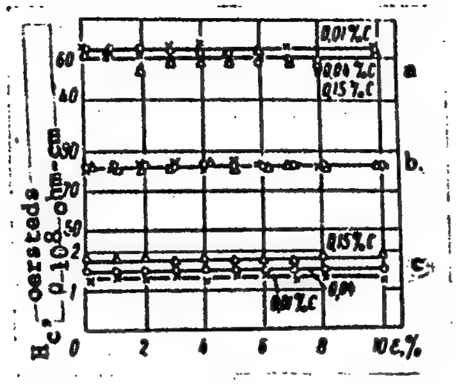

Fig. 1. Height of the 40-degree maximum of internal friction, electric resistance and coercive forces as a function of degree of prior deformation.

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L 12171-66

ACC NR: AP6000176

comitant change in the kinetics of segregation of C from the solid solution. The height of the 40-degree maximum of internal friction, electric resistance, and coercive force measured after quenching of pre-deformed specimens from 600°C (Fig. 1) remain unaffected. Apparently the cyclic stresses applied to the specimen during the measurement of internal friction are too small to upset the equilibrium of the C atoms present in the dislocation zones near the grain boundaries. Part of the dissolved atoms will be arrayed in a more ordered manner in the neighborhood of lattice defects and thus reduce the height of the 40-degree maximum of internal friction. On the other hand, the temperature of treatment (quenching from 600°C) is sufficiently high to cause part of the C atoms bound in both the old defects (grain boundaries) and the new defects caused during deformation, passes into the solid solution. Thus it seems that these conditions of experiment result in a new equilibrium state of the solid solution, at which the C concentration and hence also all the physical characteristics investigated in this study differ little from the initial state. Orig. art. has: 3 figures.

SUB CODE: 11, 20/ SUBM DATE: 14May65/ ORIG REF: 006/ OTH REF: 003

Card 3/3 HW

L 39688-65 EWT(d)/EWT(m)/EWP(w)/EPF(c)/EWA(d)/EWP(t)/EWP(v)/EWP(k)/T/
EWP(z)/EWP(b)/EWA(h) Pf-4/Pab MJW/JD/WB/EM
ACCESSION NR: AP5008390 S/0148/65/000/003/0157/0160

49
42
B

AUTHOR: Andreyev, Yu. G.; Zakharov, Ye. K.; Kidin, I. N.; Lizunov, V. I.; Maksimova, O. V.; Shtremel', M. A.

TITLE: Heat treatment by electrical heating of high-strength steel

SOURCE: IVUZ. Chernaya metallurgiya, no. 3, 1965, 157-160

TOPIC TAGS: high strength steel, electrical heating, superstrength steel, steel heating, low alloy steel, complex alloy steel, steel heat treatment, conventional heating, steel strength, steel ductility, steel hardness

ABSTRACT: Conventional heat treatment of large welded superstrength shells presents difficulties since the shells require protection against oxidation and decarburization. Therefore, an attempt has been made to use rapid-rate electric heating without a protective atmosphere or vacuum. Specimens of cold-rolled, annealed VKS-1 (42Kh2GSNM) superstrength steel 3.3 x 9.2 x 320 mm, were resistance heated with an alternating current of 50 cps to temperatures of up to 2500C at a rate of 73C/sec and air cooled at a rate varying from

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L 39688-65
ACCESSION NR: AP5008390

3

50 to 80C/sec. The resulting steel structure and properties were compared with those obtained with conventional heat treatment (austenitizing at 940C for 40 min in a vacuum of 10^{-2} mm Hg followed by air cooling). It was found that the surface microhardness was 70 H_{200} lower than the core microhardness in specimens electrically heated to 1100C, as compared to 120 H_{200} in those conventionally heat treated; but in both cases the decarburization extended only to a depth of 0.04 mm. The hardened specimens were tempered in air at 200—600C for 1 hr (at 300C, for up to 4 hr). No significant difference in the microstructure of electrically and conventionally heat treated specimens was observed. Electrically heated (to 1100C) specimens, however, had a mean grain diameter of 8 μ, as compared with 11 μ in conventionally heat treated specimens. The hardness obtained by conventional hardening from 940C can be achieved by electrical heating to 1100C. Specimens electrically heated at a rate of 75C/sec to 1100C, air cooled, and tempered at 300C for 4 hr had a tensile strength of 192 kg/mm², an elongation of 3.4%, a reduction of area of 34%, and a bend angle of 33°, compared to 195 kg/mm², 3.4%, 33%, and 26° in conventionally heat treated steel. There are two groups of martensitic steels with a tensile strength of up to

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L 39688-65
ACCESSION NR: AP5008390

200 kg/mm^2. The VKS-1 is a comparatively low-alloy steel which contains only 0.07% V and 0.50% Mo and acquires a high strength with tempering below the temper brittleness range. For steels of this group, the use of electrical heating has definite advantages. Steels of the second group contain 1—2% Mo and less than 0.5% V and require tempering at about 500C. Electrical heat treatment of a typical steel of this group, 40Kh5SM1F (Vascojet 1000) steel containing 0.43% V and 1.27% Mo, sharply increased the embrittlement in the temper brittleness range and produced a strength 10—30 kg/mm^2 lower than conventional heat treatment. Orig. art. has: 2 figures and 1 table. [MS]

ASSOCIATION: Moskovskiy institut stali i splavov (Moscow Institute for Steel and Alloys)

SUBMITTED: 02Jul64 ENCL: 00 SUB CODE: MM, IE

NO REF SOV: 002 OTHER: 003 ATD PRESS: 3229

Card 3/3

KIDIN, I.N.; MOROZOVA, T.S.

Dependence of the kinetics of rapid heating on the phase constitution of cast iron. Izv. vys. ucheb. zav.; chern. met. 8 no.9:176-179 '65. (MIRA 18:9)

1. Moskovskiy institut stali i splavov.

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000722510018-5"

N L 13071-66 EWT(m)/EWP(w)/T/EWP(t)/EWP(k)/EWP(b)/EWA(c) JD/HW

ACC NR: AP5028578 SOURCE CODE: UR/0148/65/000/011/0136/0140

46
45

AUTHOR: Kidin, I. N.; Marshalkin, A. N.; Gokhberg, Ya. A.; Marchenko, V. Z.; Mizonov, Yu. M.; Kachapin, A. A.

ORG: Moscow Institute of Steel and Alloys (Moskovskiy institut stali i splavov) B

TITLE: Effect of the deformation of austenite prior to patenting on the properties of carbon-steel wire A

SOURCE: IVUZ. Chernaya metallurgiya, no. 11, 1965, 136-140

TOPIC TAGS: carbon steel, wire, rupture strength, plasticity, metal drawing, metal heat treatment, material deformation, ultimate strength, fatigue strength

ABSTRACT: The authors present the results of an experimental method for improving the strength and plasticity of carbon-steel wire by combining its thermomechanical treatment with sorbitizing and cold deformation by drawing. In view of the difficulties that might be encountered when thermomechanical treatment is combined with deformation by drawing (possibility of rupture, etc.), the thermomechanical treatment included deformation of the austenite by rolling prior to sorbitizing. The wire was heated by the electrocontact method at the rate of 50 and 400°C/sec prior to its sorbitizing. Following thermomechanical treatment (TMO) with deformation by rolling (60% reduction of area) the strength of 2.5-mm diameter wire proved to be 28 kg/mm^2 higher than following conventional patenting, and there was also some increase in

 UDC: 669.14:621.771.42

L 13071-66

ACC NR: AP5028578

plasticity which may be attributed to the onset of initial stages of recrystallization and the formation of a polygonal structure of the α-phase. On cold drawing of patented wire following its TMO the ultimate strength continually increases with increasing draft. When the draft reaches 84%, ultimate strength rises to 260 kg/mm^2, which is some 110% higher than immediately after TMO. The improvement in plasticity is such that the wire can be bent 25-28 times instead of 8-10 times and twisted 33-35 times instead of 8-12 times. This new method of producing high-strength wire dispenses with the need of employing the patenting process based on the use of lead and salt baths, makes it possible to obtain a wire with higher mechanical properties than following conventional patenting and cold drawing, increases by a factor of 2 or 3 the rate of heat treatment and markedly expands the possibilities for its automation. Orig. art. has: 2 tables, 4 figures.

SUB CODE: 11, 13/ SUBM DATE: 12Apr65/ ORIG REF: 004/ OTH REF: 001

Card 2/2 HW

L 24518-66 EWT(m)/EWP(t)/EWP(k) IJP(c) JD/HW

ACC NR: AP6009514 SOURCE CODE: UR/0413/66/000/005/0031/0031

AUTHOR: Kidin, I. N.; Shirbanyan, A. S.; Gokhberg, Ya. A.; Marshalkin, A. N.; Burkhanov, S. F.; Marschenko, V. Z.; Mizonov, Yu.M.

ORG: none

22
B

TITLE: Fabrication of steel wire. Class 18, No. 179348
19 17 18

SOURCE: Izobreteniya, promyshlennyye obraztsy, tovarnyye znaki, no. 5, 1966, 31

TOPIC TAGS: steel wire, wire production, austenitizing, deformation, patenting, cold drawing

ABSTRACT: An Author Certificate has been issued describing a method for producing steel wire, including electro-contact heating to austenitizing temperature, reduction, patenting, and cold drawing. In order to improve the mechanical properties of the wire and reduce the heat treating cycle, the wire deformation is carried out simultaneously with cooling down to 400-450C followed by patenting in air. [LD]

SUB CODE: 13/ SUBM DATE: 14Dec64/

Card 1/1 BLG UDC: 621.785.79:621.785.47:621.778.1

L 32975-66 EWT(m)/EWP(k)/T/EWP(w)/EWP(t)/ETI IJP(c) JD/HW

ACC NR: AP6017521 (A) SOURCE CODE: UR/0148/66/000/001/0141/0144

AUTHOR: Kidin, I. N.; Marshalkin, A. N.; Mizonov, Yu. M.; Kachapin, A. A.

ORG: Moscow Institute of Steel and Alloys (Moskovskiy institut stali i splavov)

TITLE: The use of electrothermomechanical working in the production of high-strength wire

SOURCE: IVUZ. Chernaya metallurgiya, no. 1, 1966, 141-144

TOPIC TAGS: electric power source, hot working, high strength metal, drawing, mechanical property, carbide phase, wire, steel

ABSTRACT: A study was done on the electrothermomechanical (etmo) processing of steel wires. Micrographs of etmo wires after tempering showed oriented carbides in the working direction while the deformed austenite exhibited fragmented grains with an oriented substructure characteristic of polygonized metals. For 1 mm diameter wires, strength levels as high as 260 kg/mm^2 were obtained after etmo, with reductions in area of 40 to 50%. Mechanical properties are given as a function of tempering temperature (from 300 to 600°C) for different thermomechanical treatments and etmo. In no case did the amount of compressive deformation imparted by working exceed 35%. During etmo, the wires were heated 50°/sec by roller contacts operating from an ac transformer at 60 kv, drawn into wire, spray quenched and subsequently electrotempered. The strength of etmo wires was

UDC: 621.771.42:621.785

Card 1/2

L 32975-66

ACC NR: AP6017521

about 100 kg/mm^2 higher than for ordinary quench and temper treatments, due to the suppression of both carbide coagulation and recrystallization. Also, a beneficial structure orientation resulted as evidenced by x-ray patterns. Because the rapid heating maintains more carbon in solid solution, the width of the (110) and (220) lines was greater than for ordinary quench and temper treatments. Since tempering at 500°C decreased the strength from 240 to 170 kg/mm^2, the effects of cold working by drawing were examined as a means of obtaining better mechanical properties. With 75% deformation the yield stress rose to 240 kg/mm^2 with a reduction in area of 28 to 32%. Orig. art. has: 5 figures.

SUB CODE: 11/ SUBM DATE: 11Aug65/ ORIG REF: 005

Card 2/2